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NRO REVIEW COMPLETED

15 JAN 1963

MEMORANDUM FOR : Deputy Director (Research)

SUBJECT : Development of an Ultra High Acuity  
Photographic System

1. This memorandum contains a recommendation in Paragraph 5 for the approval of the Deputy Director (Research).

2. Background:

a. The basic limitation of our photographic reconnaissance systems today is in the silver halide film. The finer the grain or higher the acuity - the slower the emulsion. The 50-132 film in COMBAT and the 50-213 film in ORCAUT has a maximum resolving power of 225 lines per millimeter (at a contrast ratio of 1000 to 1) with an ASA rating of about 3. On the other hand, GSO2 film can resolve only 70 lines per millimeter (at a contrast ratio of 1000 to 1) while the speed of this emulsion is an ASA of 200.

b. The recognition of this basic physical limitation of silver halide forced the Government to spend millions of dollars on "unconventional" film over the last few years. The most encouraging of the Air Force programs appears to be the techniques and materials under development by [redacted] arranged a briefing for you by [redacted] in October 1962.)

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c. The Air Force has contracted for a black and white "free radical photographic process" for a reproduction material and a longer range black and white taking material. Both of these processes show considerable promise; however, the Air Force has restricted the research and development to a relatively narrow scope. For example, [redacted] stated that Wright Field has indicated no requirement for color taking emulsions, rather their end objective is a black and white photo sensitive material capable of resolution in the order of [redacted] This long [redacted] that two [redacted] color or single color (cyan, magenta, green, etc.) could be developed in a much shorter time span, perhaps eighteen months. The

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current Air Force funding and specifications will not permit deviations to investigate potential pay-off areas which have been uncovered in the course of normal research and development.

d. We would certainly not propose to dilute or duplicate the Air Force effort, but rather have discussed augmenting the level of effort [ ] to expand the research base into the one, two, or three color emulsion development.

f. SPIE at Westover received the first two rolls of reproduction material for testing over a month ago, but have been unable to use the material since the processing device is not ready. The material is fixed by heat at 120°C rather than chemicals, therefore, processing equipment can be simple and dry. On the other hand, the printing equipment will have to be very precise in order to obtain the inherent resolution. In addition, Westover has funds approved for a pilot coating facility which has not been issued [ ] as yet. There are certainly a number of problems involved in moving from laboratory samples of emulsion coatings to mass production techniques. In this area Westover has the project funds and control.

g. [ ] have proposed an eighteen month program at a cost of [ ] combine photopolymerization techniques and free radical formation of color to achieve the following results:

(1) A negative or positive film of camera taking speeds (ASA 10 to 100 possible).

(2) A choice of ranges of spectral sensitivity, with sharp response.

(3) Ultra high resolution [ ]  
Since this is a dye process, it is essentially grainless and this portion of the development has already been demonstrated.

(4) A dry photographic system. However, as research continues it may be advisable to accept a washbath or single chemical wet step in the process, if it increases the film speed or offers a usable product in a shorter period of time.

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(5) A low cost product. The dye emulsion should cost only pennies per square foot compared to silver emulsions at about 50¢ per square foot.

### 3. Impacts

a. The successful development of an inexpensive film and reproduction media will revolutionize the photographic industry. Even in the amateur field the impact would be tremendous since a contact print can be made with a single electric flash unit (the same used to take the picture originally) and both the original and copies can be "processed" and fixed on any electric hot plate.

b. If we can simultaneously achieve speed and high resolution, the necessity for image motion compensation devices and stabilization, with the resulting bulky and complicated equipment could be virtually eliminated. The ability to use high shutter speeds is a simple substitute for these techniques.

c. On the other hand, although existing lens systems could immediately show a significant increase in system resolution to maximize the potential of the lens-film combination, a new approach to optics would be required. Systems would become lens limited.

d. With high shutter speeds in existing aerial reconnaissance systems, the lens-film dynamic resolution should approach the static resolution capability of the lens. In this manner you could expect to double the information content of any current system (CORONA, GCACT or REALIST).

4. Summary: A proposal for developing an ultra high resolution "color" film with an ASA rating of between 10 and 100 has been received from [redacted]. The proposal appears feasible and although progress of the research and development effort may be in phases (with step increases in speed), there is a possibility of having a limited quantity of material for use within a year. A film emulsion which is almost grainless combined with speed would have tremendous impact on aerial reconnaissance. It is felt that the potential capability greatly over-shadows the calculated risk in backing such a program. The primary potential improvement would be directed toward GCACT, which under present conditions is projecting two foot ground resolution whereas a fast high-resolution film would afford [redacted] capabilities. This endeavor falls within the scope of our 72-1703 development program. The costs may be absorbed from funds programmed for Photographic Material and Processing.

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[Redacted]

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5. Recommendation: That approval be granted to enter into a contract with [Redacted] in the amount of [Redacted] for development of [Redacted] taking film. This project can be incrementally funded for [Redacted] in FY-1964.

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(Signed) Jack C. Ledford

JACK C. LEDFORD  
Colonel USAF  
Assistant Director  
(Special Activities)

CONCUR:

/s/ [Redacted]  
Chief, Development Division, CIA

\_\_\_\_\_  
Date

/s/ [Redacted]  
Chief, Contracts Division, CIA

\_\_\_\_\_  
Date

/s/ [Redacted]  
Acting Comptroller, CIA

\_\_\_\_\_  
Date

Recommendation in Paragraph 5 APPROVED:

Not signed. 12 April 63  
ml

\_\_\_\_\_  
Date

ROBERT SCOTT, Jr.  
Deputy Director (Research)

DD/CSA [Redacted]  
(7 January 1963)  
Distribution:  
1-PA/CSA  
2-DO/A  
3-DO/SA  
4-DO/ISA  
5-DO/CSA  
6-DO/CSA  
7-DO/CSA  
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9-DO/CSA  
10-DO (Group)

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5. Documentation That approval be granted to enter into a contract with [Redacted] in the amount of [Redacted] for development of "SACRED" [Redacted] This project was incrementally funded for [Redacted] in FY-1964.

(Signed) Jack C. Ledford

JACK C. LEDFORD  
Colonel USAF  
Assistant Director  
(Special Activities)

COMMENTS:

/s/  
Chief, Development Division, CIA

\_\_\_\_\_  
Date

/s/  
Chief, Contracts Division, CIA

\_\_\_\_\_  
Date

/s/  
Acting Comptroller, CIA

\_\_\_\_\_  
Date

Recommendation in Paragraph 5 APPROVED:

*Not signed. 12/4/63*  
*ml*

ROBERT BOYD, Jr.  
Deputy Director (Research)

\_\_\_\_\_  
Date

ED/CIA [Redacted]  
(7 January 1965)  
Distribution:  
1-ED/CIA  
2-ED/PA  
1-ED/PA  
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3-ED/PA  
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8-ED/PA  
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10-ED (Chrono)

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[Redacted]

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